THE ADVANTAGES OF THE NICARAGUA ROUTE.*

The engineering details of the Nicaragua Canal route are contained in reports extending over a series of twenty years, and culminate in the perfected location of 1890. The line has been surveyed and re-surveyed, the most important problems have been passed upon by prominent experts, and it remains to-day, the most feasible route through which ships will pass from the Atlantic to the Pacific.† A discussion of the advantages of the route of the canal as at present located includes a consideration of (1) the Lake of Nicaragua, its advantages to an isthmian canal, and (2) its approaches, natural and artificial.

During the early days of October, in the year 1870, a moderate sized steamer, drawing ten feet of water, left New York harbor, and within a month, anchored in an inland sea within eleven miles of the Pacific Ocean. A sailor going aloft upon the mast of that steamer would, at the height of forty-two feet, have been above the summit of the divide between the vessel and the Pacific, and might have seen the spars of a vessel at anchor in Brito roadstead, the western terminus of the Nicaragua Canal. I was on board the steamer and was forcibly impressed with the feasibility of cutting through that low barrier, of deepening the outlet to the eastward, so as to provide an interoceanic waterway for the fleets of the world. Several years afterward, I was, for one hundred and twelve days, out of sight of all land, trying to reach Narragansett Bay from San Francisco.

Within a distance of twenty miles northward and westward of the place where this steamer was anchored on Lake Nicaragua, is one of the richest regions of the globe.

*Discussion at the Thirtieth Scientific Session of the Academy, November 13, 1895.

† For a description of the route to be followed by the Nicaragua Canal, and for a history of the Maritime Canal Company of Nicaragua, consult pages 137–141 of the monograph on "Inland Waterways: Their Relation to Transportation," by Emory R. Johnson, published as a supplement to the ANNALS, September, 1893.

Three miles from the lake are the indigo plantations of Rivas, the "pilas" or vats for soaking the plants built of the lime with which the locality abounds. The concrete used in constructing these vats is as smooth as porcelain, as hard as marble, and as old as the Spanish conquest, the continued stability of the vats attesting the freedom of the locality from volcanic disturbance. Farther on are the cacao plantations as valuable as they are beautiful; while here and there in the vicinity of the towns are the sugar haciendas and the coffee lands, interspersed with farms devoted to the culture of the plantain, the banana and the orange.

The Central American Cordilleras exist in one unbroken chain the entire length of the isthmus, but at one point, and that point near Rivas, they sink to the lowest elevation on the American Continent, becoming simply hills which skirt the Pacific shore. As the highlands to the westward lose their altitude, the valleys to the eastward gain in extent, forming a basin into which the mountains of Costa Rica and Nicaragua pour the vast amount of water which drains from their lofty sides.

This basin is the Lake of Nicaragua, or Granada. It covers an area one hundred and ten miles long by forty broad; is in places over one hundred fathoms deep; contains a channel from its eastern to its western extremity, capable of floating the largest ships; is only one hundred and ten feet above the ocean; and by reason of its magnitude, is subject to none of those *extreme changes of level so common to all bodies of water situated in the tropics.* Freshets never occur, either in the lake or in the San Juan, for the first sixty-four miles of its course. It is the only river of the tropics not subject to sudden rises. It flows through a narrow valley the greater part of the sixty-four miles, with an average depth to-day of forty feet during the last eighteen miles. It has no large tributary streams swelling its current, and a dam of fifty-two feet is perfectly practicable near the

San Carlos river. With this dam built, continuous lake and river navigation can be secured for one hundred and thirty miles; leaving only forty miles of actual canal and artificial basins. I emphasize this point because one of the objections raised against the Nicaragua route is its length. Every seafaring man will acknowledge that one hundred and thirty miles of smooth water navigation would be preferable to the "northers" of the Gulf of Mexico, and the tropical calms obtaining north and south of Nicaragua, beyond the trade-wind belt. Commanders of iron vessels also know what advantages there will be in ridding their ships from barnacles.

Lake Nicaragua is a reservoir capable of supplying a uniform and practically inexhaustible amount of water. The gauges of the San Juan showing a flow of over nine hundred million cubic feet per day. The lake is also of great importance, as it divides the canal into two distinct sections, and consequently eliminates any danger from a "block." Vessels will be locked directly up to the lake, where they can remain quietly at anchor in fresh water, loading under the lee of the numerous islands with the products of the country, repairing any damages with timber of the best quality, or provisioning for the coming ocean voyage. The lake is then the great port of the canal and in considering the question of harbors at either terminus, it will be well to remember that they can be limited in size to the accommodation of the few ships which may daily arrive. This is specially true for the Pacific division, for if the weather prove inclement, the outgoing vessels can remain in the lake, and be locked down the sixteen miles whenever desirable.

The outlet of the lake to the eastward is the San Juan River. Sixty-four miles from the lake the river passes between two sharply defined hills. Here, at Ochoa, a dam is to be built, raising the stream to the lake level.

I well remember when Mr. Menocal, the distinguished engineer who has given his life to this work on the isthmus

informed me several years ago of his fear that the raised waters of the San Juan might overflow by some lateral channel near the dam before they reached the crest of the dam. That fear was well founded, for a small creek was found entering the left bank of the river. The engineering party examined the creek and discovered a break in the hills some two miles above the proposed dam, beyond which lay an extended valley shaped like a huge Y, the left or westerly arm of the Y resting in the hills near the Ochoa creek, its right or easterly arm stretching toward the Atlantic. Was the river to be raised only to waste itself over these miles of swamp, and thus neutralize and destroy the canal? Once more the parties examined the valley, and at the end of three months of perfected labor discovered, that down the western arm of the Y flowed the river San Francisco, almost parallel with the San Juan, but separated from it by a range of hills, while through the eastern arm ran another small stream; the two uniting at a point nine miles from Ochoa. Here, at the stem of the Y, it was perfectly practicable to build an embankment. Thus was made possible a large reduction in the original estimates, for the whole valley of the San Francisco is to be made a submerged basin. The San Juan waters are to be backed around through the San Francisco valley, and the summit level will be made one hundred and fifty-two and one-half miles long instead of one hundred and thirty. Solid natural walls of rock enclose this basin to the northeast. The hills to the east of this artificial basin form the great divide. It is proposed to make a cut through this divide one hundred feet deep and three miles long. The summit level will end with three locks, cut in solid stone near its eastern end. They bring the canal to the ocean level and within nine miles of the Caribbean Sea. This cut through the divide is not a misfortune but an advantage, because the rock obtained from the cut will be needed in constructing the Ochoa dam and the breakwater at Greytown.

The remaining work is simply dredging through a swamp, and out to the deep water off the coast, the restoration of Greytown Harbor having been proved a simple problem, as I prophesied twenty-three years ago it would be.

When the canal is completed the harbor of Greytown will extend to the foot of the hills. Here upon their undulating, healthful sides will be the future city and port. Mounting the three locks, a ship in transit will enter the Deseado basin, and after passing through the divide cut, will be in the broad waters of the flooded San Francisco valley, which is practically an extension of the great lake to this point, thence the ship will steam with favoring trade winds up the deepened San Juan and, crossing the lake, will continue, still on the summit level, for fifteen miles past the western shore of the lake, the last five miles being through the Tola basin. This basin covers four thousand acres, and lies within three miles of the coast. From the basin the vessel will be locked down to the level of the Pacific. Such is the route decided upon after years of research. Each year bettering the line physically and financially, until in the opinion of the company it ought to cost not more than $70,000,000.

The waterway connecting the Atlantic and Pacific should, in some way, be under the supervision of the United States. Our destiny on the Western Hemisphere demands this. Recent indications would seem to show that England will not oppose the control of the canal by America, but will permit her citizens to unite with us in providing the funds necessary to complete the enterprise.

I do not present any definite plan as to its construction. As an American I should much prefer to see it under the control of this country; the manner of such control can be left to the wise discretion of Congress. We, of the Nicaragua Canal companies have spent some $4,000,000 already in the enterprise, and, with confidence in the future, will keep on with the good work, but we cannot any longer with justice to ourselves, wait for governmental action in this

country, and refuse the offers of money which come to us from Europe. The time has arrived when the leading citizens of every town must put their shoulder to the wheel, and see to it that funds are raised in the United States, unless the people are willing to allow Europeans to have a large minority interest in the canal.

J. W. MILLER.

New York City.